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East Europe Report

SCIENTIFIC AFFAIRS

No. 697

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SSR S & T DEVELOPMENT GOALS IN SEVENTH FIVE-YEAR PLAN

Bratislava SMENA in Slovak 5 Jan 81 p 3

[Interview with Eng Julius Pavlis, deputy minister of construction and technology of the SSR, by Tatiana Jaglova: "The Linkage of Science with Practice--A New Approach to the Management of Science and Research in the Seventh Five-Year Plan"]

[Text] Experience proves that those who make sensible investments achieve good results. Sensible investments, however, consist of many different aspects—from anticipating future demands and prospects, through organization of details during the planning stage, up to the management and implementation of scientific research tasks whose results should help develop some branch of our national economy, without wasting any money, in order to achieve the desired results from every investment in science and research and to put research programs in the focus of the state plan. These are the demands of the scientific technical development in the new five-year plan, we were informed by the SSR deputy minister of construction and technology, Eng Julius Pavlis.

[Question] What are the main directions and tasks of the scientific technical development in the Seventh Five-Year Plan?

[Answer] The party and governmental organs recently approved the proposal for the state operational plan for technological development in 1981. Preparations for the proposal for the Seventh Five-Year Plan are progressing rapidly. As for the main directions and tasks contained in the proposal for the Seventh Five-Year Plan, 13 percent are focused on conservation of fuels and energy, 28 percent on conservation of raw materials and materials, 17 percent on improved trade balance, 23 percent on the growth of labor productivity, and 18 percent on shaping and protecting our environment. Scientific research programs in electrical engineering are concentrating on the development of a projected system of small SMEP electronic computers, new technologies and production of cables and electronizing materials; on the development of a new generation of processing equipment using concentrated power, on exploitation of ultrasound in the development of more efficient new equipment and machinery, and on the development of electronic medical equipment. In metallurgy and machine engineering we focus on new technology for the manufacture of aluminum oxide from domestic raw materials, on automated systems with semiconductor converters for the development and introduction of industrial robots and handling equipment, and on the development of blasting technology for mineral

working. In fuels and power we focus on rationalization and conservation of fuels and energy, higher safety and operational reliability of nuclear power plants, building of underground storage for natural gas, and development and testing of nuclear technology systems for human and veterinary medicine and for environmental protection. In chemistry we seek the development of tough polyvinyl chloride for the manufacture of pressure tubes, polypropylene fibers with better utility properties, new pesticides, and oil refining. In wood, cellulose and paper industries we focus on utilization of the biomass and of secondary raw materials, on new wood-processing technology and utilization of low-quality wood species in paper manufacture. In textile industry we stress more efficient utilization of textile wastes and the development of decorator textiles. In construction we seek higher weight capacity of bridges, whole wall and roof units from porous concrete, better quality concrete, new types of ceramic products, and substituting gravel sand with crushed stone. In agriculture and nutrition we emphasize intensification of the vegetable and animal production, exploitation of the East Slovakia lowlands for higher yields of grass and corn, intensified sheep farming, mechanization of operations in mountainous and hillside areas and fruit and vegetable harvesting. In geology we focus on the search for areas with potential deposits of crude oil, natural gas, mineral raw materials, and thermal and drinking water.

It is an advantage that the tasks of the state plan are closely linked with state target programs now in preparation and with international cooperation. The state plan was successfully tied more closely with ministerial and sectoral programs where 32 percent of tasks are financed by enterprises from their own resources.

[Question] Frequently it has been advantageous for our science to work on essential programs together with the Soviet science. Could you mention some examples and advantages of such scientific cooperation?

[Answer] The cooperation between the Research Institute for Organic Technology, the NIICHimpolymer Institute in Tamov and the Gioroochima NPO Plastmassy in Moscow in the field of rubber chemicals has progressed most satisfactorily. Its results provided a basis for the planning of a large-capacity unit for CD antioxidant with a 12,000-ton capacity. Here the CEMA coordinating center at the State Wood Research Institute in Bratislava accomplished a pioneering piece of work. New technologies, machinery and equipment were developed by joint efforts of the member countries. Mutual deliveries anticipated for the 1981-1985 period will amount to 49,736 units.

The cooperation of the Computer Technology Research Institute in Zilina with the SMEP program helped accelerate the development of selected models. Recent international tests of new models of computers have demonstrated that when compared with the most advanced foreign products, we had considerably narrowed down the differences in technological standards. We intend to intensify this cooperation even more in the course of the Seventh Five-Year Plan.

[Question] What progress was made by the idea to organize research centers in various towns and how does this solution aid the development of science in specific areas?

[Answer] It is not a new idea to organize new research centers in accordance with the given natural conditions of individual areas, in agreement with the industrial, cultural and social development of a particular town. However, we are returning to it now even more emphatically in conjunction with the comprehensive approach to the building and more efficient utilization of our research and developmental base. By its decision No 254 of 1978 the SSR Government approved programs for the purpose of establishing research and developmental institutes in industrial centers in Slovakia so as to bring science, technology and their practical implementation closer together. Several areas were selected for their distinctive concentration of operations continuing the process of research and development.

In the first place is Bratislava, with 39.2 percent of the research and developmental base in the SSR concentrated there. At present this idea may be implemented because colleges, industrial enterprises and other institutions organized in other towns in Slovakia offer preconditions for good and efficient operations of research and developmental institutes. The Research Institute of Transportation in Zilina is connected with the College of Transportation. Moreover, research and computer technology is concentrated here. The town of Nitra has become the center of agricultural research where college-educated workers receive their training. Machine engineering production which is concentrated in Martin and Povazska Bystrica is linked with a large-capacity research and developmental base. Forestry research and mechanization of forestry operations are concentrated in Zvolen, and textile and glass research in Trencin. East Slovakia, and in particular Kosice, receive special attention because of their advancing research and development linked with local industry and basic research connected with colleges.

Thus regulated, research, production and training of cadres offer better preconditions for accelerating the entire cycle, beginning with research, through development, up to implementation. Furthermore, more advantageous opportunities are provided for furnishing research institutes with superior special equipment and for its more efficient utilization. Thus, for instance, we plan to build a central laboratory adjunct to the Research Institute for Animal Production in Nitra which will contain unique technological equipment to be used jointly in the whole area of animal production. About 3,500 employees of the research and development base will be integrated into the Heavy Machinery Works economic production unit as soon as 1 January 1981.

A scientific production association, planned as an experiment, will be organized in Zvolen and combine the Forestry and Lumbering College, the Forestry Research Institute, and forestry production enterprises in Zvolen and Banska Bystrica. A research production association to be organized during the Seventh Five-Year Plan in the East Slovakia lowlands will use as its base the Comprehensive Agricultural Station in Michalovce and related agricultural organizations. United institutes for research and development associated with the Slovak Academy of Sciences, the Technological College in Bratislava, the Tesla Company in Piestany and several other organizations are under construction in Peistany.

[Question] Research achievements must be demonstrated in their practical application. What steps have been taken to that end?

[Answer] The Set of Measures for Improving the Planned Management System of the National Economy after 1980 charges the area of the management of scientific technological development with the task of choosing the programs for our national economic needs objectively, to specify their economic contribution, and to project their relevant consequences into other sections of our national economic plans, such as the plan for industrial production and marketing, the plan for agricultural production, and so on. The application of the time factor as an indicator for the assessment and selection of tasks has been expanded. Furthermore, this concerns absolute and relative savings; risks and uncertainties in research and development are identified, and alternative decisions are made possible.

Price regulations had to be adjusted in calculations of specific economic contributions. Preliminary and final price limits for products which represent solutions of the research tasks are set and approved on that basis. Such price limits should reflect the technological level of their solution, their high profitability and thus, their contribution to our national economy, unfortunately, thus far those tools have been applied in the preparation stage very unsatisfactorily, and therefore, in 55 percent of the proposals submitted for research programs, prices were based on the comparison of technical-economic indicators with current prices of our products rather than with the world prices.

[Question] At a press conference you told the journalists that the institutes will be given more authority particularly in financial matters--namely, the authority of directors to allocate funds for various purposes. How will this be implemented in the immediate future?

[Answer] In the new system of planned management after 1980 certain deviations from the generally mandatory regulations are anticipated in the financial management system. The method of management in individual organizations will depend on the organizational form to which the organization in question will be assigned. The specifics applicable for research and development organizations pertain most of all to certain allowances in the tax system. For instance, no property taxes will be collected. Social security contributions will amount to 10 percent of the wages, and the tax on profits will be assessed according to the current progressive scale. An amended announcement concerning financing of non-investment expenditures for scientific technological development which has been drafted for the area of financing of the scientific technological development specifies the volume of costs expended by organizations for research and development programs, the expenditures for programs of scientific and technological development, the regulations for grants in that area, and the options to pool funds for the scientific and technological development in ministerial programs with cross-sectional effects, and in works connected with the operations of a leading institute or an information center operating cross-sectionally. Those regulations emphasize the pressure on the enterprises and economic production units to create their own resources and to participate in financing the tasks of the plan for scientific-technological development.

9004
CSO: 2402

HUNGARIAN SYSTEM FOR EXPANDING COMPUTER STORES

Budapest SZAMITASTECHNIKA in Hungarian Nov 80 p 4

[Interview with Zoltan Emodi, department head at NIM IGUSZI, Gyorgy Harsanyi commercial director of Labor Instrument Works and Gabor Reich, main department chief of the National Computer Technology Center by Csanyi and Keszthelyi: "Store Expansion---Hungarian Style"]

[Text] We recently received an information bulletin from the National Computer Technology Enterprise in which we read about devices, methods and ideas for increasing the efficiency of the ESZ 1022 computer system. These included a domestically developed semiconductor operational store as a possibility for store expansion whose capacity can be extended from 128 to 512 Kbytes as needed. This information aroused our interest. Who developed it? Where is it manufactured? What will it cost? When can it be obtained? These and other similar questions to which we sought answers occured to us. Thus we came to the NIM IGUSZI [Institute of Industrial Economy and Business Organization of the Ministry of Heavy Industry] which developed it, the Labor MIM [Magnesite Industry Works] which manufactures it and the OSZV [National Computer Technology Enterprise] which markets it.

NIM IGUSZI

Zoltan Emodi, department chief at the NIM IGUSZI.

We decided about 2 years ago to expand the operation store capacity of our ESZ 1022 computer. We could choose between two alternatives. Either we could guy a 256 Kbyte ferrite memory for about 11 million forints or we ourselves could develop and make a similar semiconductor store and thus saved a considerable sum. We chose the latter. Those participating in the work, in addition to myself, were Jozsef Urik, Gyorgy Kiraly, Dr Adam Beothy, Ivan Kiss and Karoly Csebfalvi.

[Question] What is the task of the technical department? Is it usual to develop hardware in an organization institute?

[Answer] The task of our department is to maintain and service the four computers of the institute. I cannot say whether it is usual to develop hardware in an organization institute.

[Question] Why did you undertake the development? Do you have too little work or too many people in the department?

[Answer] No. There is not too little work and we are not more than needed. Something else is involved. It is well known that the work load of maintenance and service personnel is not even. At the same time, the people are needed because when there is a problem they must work quickly and effectively.

[Question] So you used the time between periodic tasks to develop the equipment?

[Answer] Yes. Instead of playing chess or reading newspapers in the "waste time" we could do useful work. It is sensible because in the course of developmental work we are further training ourselves and keep up with technical development and it is useful because we could save money for the institute.

[Question] When was the new equipment finished and how did it succeed?

[Answer] We were ready by the end of last year. Instead of the planned 256 Kbyte store we came up with a 512 Kbyte store. In addition to substantially lower costs, the size of the equipment is one-third that of a corresponding ferrite store, its power requirements are less and servicing it is many times simpler.

[Question] You have used the new store successfully since then. As we know, manufacturing preparations have begun too. How did a domestic development become a commercial item, a product for series manufacture?

[Answer] The news of our development spread quickly, many came to look at it and learn about it. Experts from the Labor MIM learned of our work too. They then indicated that they would be happy to undertake manufacture. So it happened that the Labor MIM bought the manufacturing rights.

[Question] What is your link with the manufacturer; how do you help their work?

[Answer] The link is very good. We prepared all documentation for them. We have the right of supervision over manufacture. We wrote strict requirements. Two units have been made already, which we tested. These may reach customers this year.

[Question] Will there be more? Will you develop semiconductor stores for other types of computers?

[Answer] Yes. One is practically read for the SZM-4. We are working on a store which can be connected to the ESZ 1020. There is talk of our developing a memory for the IBM 360/40 too. I might note that with a slight modification we solved operation with the ESZ 1022 one Mbyte operational store.

Labor MIM

At the Labor Instrument Industry Works our questions were answered by Gyorgy Harsanyi, commercial director.

[Question] What were the antecedents to your undertaking manufacture of the semiconductor store?

[Answer] For a long time our enterprise has been manufacturing complete laboratories. We keep up with developments, so after the appearance of microprocessors we built them into our instruments. In the beginning, we manufactured microprocessor

equipment only in Budapest but last year we set up our electronic division in Esztergom. We think that manufacture of the modern semiconductor store developed by the NIM IGUSZI will provide good opportunities for the development of a developed technological culture in our Esztergom division.

[Question] What size user need can you satisfy?

[Answer] Considering the throughput time for parts acquisition, we can satisfy all solvent demand ordered 1 year in advance.

[Question] At the moment, how many units are on the "assembly line"?

[Answer] Two stores have been made already. Another six units are 90-percent complete; we can deliver these early next year.

OSZV

Finally we interviewed Gabor Reich, a main department chief, as representative of the National Computer Technology Enterprise, which is doing the marketing.

[Question] How much market work has the OSZV done to survey domestic demand for the semiconductor store?

[Answer] We picked out a few representative users and questioned them. We received three sorts of answer. In the first place, they do need the store. In the second place, they would like to achieve a total capacity of one Mbyte in order to do modern remote data processing on their ESZ 1022 systems. (It is probable that this will be possible.) In the third place, they do not want to increase storage capacity with new equipment. Our survey showed that there is a need for the store so we developed close contact with the developer and the manufacturer. Several unclarified questions--in regard to the contract to be signed with the manufacturer--hindered our marketing work at the beginning. Now the contract is ready and will be signed in a few days. This year we delivered a 512 Kbyte semiconductor store for the UTORG [Transport Construction Organizing and Data Processing Association] and a 256 Kbyte semiconductor store for the ZALASZAM [Zala Megye Computer Center].

[Question] What price are you asking, for example, for the 256 Kbyte version?

[Answer] It will be about 5.5 million forints, including installation, instruction and guarantees. Service will be at a higher level than is customary. The Labor MIM has undertaken to replace faulty parts or panels within 72 hours.

[Question] Do you have prospects for 1981?

[Answer] Technical-commercial preparation and market work are under way now. There will certainly be customers for the quanity planned by the Labor MIM for next year. Our potential customers include the MUSZI [Office for the Organization of Agricultural Business Management], the EMASZ [Electric Power Service Enterprise of Northern Hungary], the Dunaujvaros college, the DEMASZ [Electric Power Service Enterprise of Southern Hungary], the Lenin Metallurgical Works and the OAF.

8984
CSO: 2502

TMX 2410 DATA TRANSFER MULTIPLEXOR DESCRIBED

Budapest SZAMITASTECHNIKA in Hungarian Nov 80 p 16

[Article by Dr Ivan Szabo: "TMX 2410 Data Transfer Multiplexor"]

[Text] On 28 October, as reported in advance by the program calendar column of our journal, the Computer Technology Department of the NJSZT [Janos Neumann Society of Computer Technology] held a very successful TAF [remote data-processing] conference at the Telephone Factory. The 55 persons present heard about the TAF product program of the TERTA [Telephone Factory], software problems of remote data processing and the role of the TERTA in the development of Hungarian TAF systems. The TERTA, as Andras Ret said, wants to contribute to the development of TAF systems for medium and large ESZR [Uniform Computer Technology System] computers. Between 1972 and 1974 the factory manufactured only offline terminals and data transfer equipment; between 1974 and 1979 it also manufactured online terminals; and since the end of 1979 it has begun manufacture and delivery of systems and subsystems. (The representatives of the factory regard a subsystem as the delivery and servicing of the necessary hardware and software elements from the multiplexor to the terminal while they regard a system as the delivery and servicing of the necessary hardware and software elements from the computer to the terminal.)

At the TAF exhibi ollowing the lectures we could see in operation the TMX 2410 data-transfer multiplexor, use of which has begun in Hungary also. In addition to the 20 units already manufactured and shipped abroad, multiplexors of domestic manufacture will be in use in Hungary--finally--by the OSZV [National Computer Technology Enterprise], the MVM [Hungarian Chemical Works], the KG ISZI [Computer Technology Institute of the Ministry of Metallurgy and the Machine Industry], and the ELGAV [Food Industry Data Processing Enterprise] by the end of 1980 and by the SZUV [Computer Technology and Management Organization Enterprise] and the Kalman Kando Technical College in 1981. The multiplexors operating in Hungary thus far support about 15-20 TAF systems. There are about as many types as there are TAF systems. This may be explained by the late appearance (1979) of a modern domestic multiplexor and by other considerations.

We heard with pleasure from the speakers that the TERTA is ready to deliver unlimited quantities to satisfy the domestic needs of users of the equipment. So there will be TERTA equipment in the domestic ESZR computer centers in addition to the already operating VT 51 200 COS, MDP1 TERTA/TAKI, VT 55 000, EMU 2703 (KFKI), the ESTEI two-system multiplexor for the ESZ 8371.01 frontend-processor for the TEL JSZ system, the MPD1 (ESZ 8401) and Honeywell-Bull CDC, IBM, etc. In the future, the TERTA wants to support their distribution with more market research, commerical and professional preparatory activity.

This domestic device will be of special significance with the dedication of the new modern Telex and Data Center of the Hungarian Post Office, only a few weeks away.

Characteristics of the TERTA Multiplexor

Area of use:

The TMX 2410 multiplexor remote-control unit connects the central computer of the remote data-processing system through data-transfer equipment to the subscriber points of the system. In the maximum version of the equipment it communicates with the terminals on 32 lines with a speed of 2,400 bit per second.

Computers which can be used:

The multiplexor can be connected to the multiplex channel of the ESZ 1020 or larger ESZR computers. It can also be connected to computers compatible with the ESZR--thus with the IBM. Its two-channel switch makes possible connection to two multiplex channels.

Software service:

The ESZR telecommunications access modes--BTAM, QTAM, TCAM, etc.--ensure TMX 2410 multiplexor operation with DOS and OS operating systems. With an operating system it can be tested with OLTEP and without an operating system it can be tested with the DMES test sections.

Types of termals which can be used:

The TMX 2410 multiplexor can service five types of ESZR terminal. Type 1--TAP-70, AP-1, AP-74; type 2--TAP-2, TAP-3; type 3--BSC transfer algoithm terminals such as, for example, TAP-34, AP-4, AP-50, EC-7920; type 4--teletype; and type 5--AP-61, AP-62, AP-63, AP-64. When operating type 1 and 3 on a multipoint line the autopoll service provides automatic--not program controlled-querying of the terminals.

Telecommunications lines which can be used:

Subscriber points can be connected to the TMX 2410 multiplexor on leased or connected telephone or telegraph lines. On a connected line one can use automatic call, initiating and automatic call reception. For better use of a leased telephone line one can connect a TMX 2400 remote multiplexor to the TMX 2410 multiplexor. ESZR line connectors with suitable speed can be used as line signal transformers--for example, the TAM-201, TAM-601, TMX-200, etc.

TBA-1

In the course of the exhibit [illegible] TAF devices, the participants at the conference could also learn a device of great signifance, the TBA-1 automatic calling equipment which works on a telephone network. This is an indispensable element of an online remote data-processing system working in a connected network and it will take the place of capitalist imports. Its operating algorithm corresponds to the CCITT V.5 standard.

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USES OF VOCAL COMPUTER ADDRESSING EXPLAINED

Budapest SZAMITASTECHNIKA in Hungarian Nov 80 p 5

[Article by Gabor Kiss and Gabor Olaszy: "Application Areas for Machine Speech"]

[Excerpt] The question justly arises as to why it is necessary to have research on the creation of artificial speech in Hungary if this is already solved in other countries. The answer is simple. Artificial speech must be created separately for each language because the problem is not purely technical but also involves linguistic elements. In the course of technical realization one must put into the computer program the linguistic rules of the language one desires to produce (at least some of them), the acoustic parameters of the sounds and links between them figuring in the language and rules pertaining to the prosodic structure of speech (accent, intonation, etc.). These data differ from language to language. Computer experiments on the production of artificial Hungarian speech are taking place in Hungary in the phonetic laboratory of the Linguistics Institute of the Hungarian Academy of Sciences. The goal is a double one: in the first place, they want to use artificial speech for basic phonetic and liguistic research; in the second place, since the link of phonetics to practice is ever closer and since the results of its are being used in a number of areas (for example, by physicians, speech therapists, psychologists, criminal investigation organs, etc.) we want to develop a speech-synthesizing system based on liguistic and technical rules which can be used effectively and flexibly in broader social and industrial applications if the necessary hardware is provided. This would make possible the production of fluent Hungarian speech, building certain words or sentences into computer programs as subroutines and the providing of various automatic services with artificial speech.

In our next article we will report on hardware and software systems connected with the production of Hungarian speech and their operation.

8984
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BASIC ARCHITECTURE OF SM 3, SM 4 COMPUTERS DESCRIBED

Budapest SZAMITASTECHNIKA in Hungarian Sep 79 p 4

[Unsigned article: "Basic Architectural Properties of the SM 3 and SM 4"]

[Text] In another place in our journal we report that the NOTO OSZV [National Computer Technology Enterprise] has purchased an SM 3 and SM 4 computer. In the following article we begin a detailed report on the two minicomputers.

For both computers the basic unit of the information to be processed is a word consisting of 16 binary place values. The chief method of depicting numbers is as a signed, fixed decimal, binary complement code.

The instruction system embraces such operations as addition, subtraction, various stepping operations, data movement, condition check, conditional and unconditional branches, subroutine call, return from subroutine, etc. The basic instruction set of the SM 4 includes all instructions of the SM 3. The SM 4 has other instructions in addition such as fixed decimal multiplication and division, floating decimal addition, subtraction, multiplication and division, multiple stepping, etc. The number of operation codes used in the instructions exceeds sixty. Combining these codes with various addressing methods results in more than 400 instructions of practical significance. The basic instruction set serves the processing of the 16 bit words but a few instructions also make possible the handling of individual bytes or even bits.

There are eight general registers in the processor. These have a length of one word and serve to hold the data to be processed as well as constants, addresses, and address elements. The instruction system is so structured as to make possible the issuing of null, single and double address instructions using the general registers and appropriate addressing methods. The instructions are listed in the following groups according to their structure: Two address instructions, single address instructions, conditional branches, control branches depending on condition and special instructions.

The addressor for one and two-word instructions has six place values. Of these three serve to give one of the eight general registers of the processor and three serve to indicate the way to use the content of the designated register or the addressing method. Selecting the addressing method actually means using the content of the previously filled register as an operand, as the address of an

operand or as the address of that store partition in which the address of the operand can be found. Use of the instruction counter as a general register constitutes a special case because this register does not have to be filled in advance and its content is always the address of the store partition following the just executed instruction. If we fill this partition with appropriately selected information, which we use in various addressing methods, we get another eight addressing methods of which, however, only four have practical significance. Thus, all together, we can speak of 12 addressing methods in the case of the SM 3 and SM 4 processors.

When executing the conditional branch instruction we define the address of the branch in such a way as to add with sign to the content of the instruction counter the magnitude of the shift. In this way the address of the branch can fall into a band of plus or minus 128 words as compared to the address of the conditional branch instruction.

The address of the operands is given in a 16 bit word. The smallest addressable unit of information is an 8 bit byte. The number of store partitions which can be accessed with a 16 bit address, the maximum store capacity, is 2^{16} or 64 Kbytes, or 2^{15} or 32 Kwords. In the case of the SM 4 store capacity can be expanded to a maximum of 128 Kwords. To address a store of this capacity a special unit (dispatcher) is needed in the SM 4 processor.

The exchange of information between various units of the computer system takes place via a so-called bus bar. Every unit of the system, including the processor, the operational storage, the peripheral units and even special equipment (such as arithmetic complements calculating the values of special functions) participate in the information flow via this bus bar. Both data and control information travel through the bus bar in 16 bits, parallel code.

The switching system is multi-level; at the highest priority level (the level of direct access) information exchange between units of the system takes place without the participation of the processor. In this case the operation of the processor is undisturbed during the time of the information exchange and as a result the capacity of the system is increased. The units connected to the direct access level require special complements. In addition the architecture permits use of seven priority levels, for various program switchings. Of these seven possible levels the SM 3 and SM 4 processors use only four. The architecture does not limit the number of pieces of equipment which can be connected to the several priority levels (including the direct access level).

The practical realization of the bus bar tolerates a maximum of 20 loaded connections (receiving or transmitting), within a distance no greater than 15 meters. If more equipment must be tied into the system or if the length of the bus bar wires exceeds 15 meters then a special unit must be used to expand the possibilities. Every such complement to the bus bar increases the number of loads by 20 and the distance by 15 meters. A remote processing device is needed to connect equipment to the bus bar at a greater distance from the processor.

Information exchange on the bus bar takes place in an asynchronous mode, as a result of which one can operate equipment of different speeds in the system. For the same reason the system can be easily modernized with the development of constituent elements.

It is an advantageous architectural property of the SM 3 and SM 4 that the registers of peripheral units can be addressed in the same way as the partitions of operational storage. Concretely defined addresses are provided for the registers of the most frequently used peripheral units or those needed to operate the operational system. These units include magnetic disk and magnetic tape storage, link printers, video terminals, punch card and punch tape input and output units and others. A special control block of the peripheral unit takes care of appropriate combining of addresses while the operational system keeps track of the values of the addresses. In the case of every other peripheral unit, including special units adapted to the peculiarities of the application area, the concrete value of the addresses of the registers can be selected from the upper 4K values of the possible address domain (taking into consideration that a few addresses are already occupied here also). If the basic operational system is to operate with these units one must prepare drive progreams for the peripheral units and they must be built into the operational system used.

The structure and architecture of the SM 3 and SM 4 prescribe special tools for building multi-computer and multi-processor systems, such tools as inter-processors adapters and bar switches. The inter-processor adapter is connected to the bus bar of both systems. By means of the adapter both processors can make use of any equipment connected to the bus bar of the other processor, including operational storage. The bar switch makes it possible to connect equipment connected to a supplementary bus bar to one or the other system. We can use the bar switch to develop multi-computer systems or to increase the reliability of the system with reserve units.

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COMPUTER PLAN CONFERENCE CONVENED IN SZEKESFEHERVAR

Budapest SZAMITASTECHNIKA in Hungarian Sept 79 pp 1, 15

[Article by Ferenc Szechenyi: "Summer University in Szekesfehervar"]

[Text] The Society for the Propagation of Scientific Knowlege (TIT) started 23 summer universities in 19 cities this year. Thousand year old Szekesfehervar has joined this series of programs for the first time and to prove its "youth" it undertook to report on application possibilities of one of the youngest branches of science (or trades?). The Technical Committee and the Agricultural and Food Committee of the National Presidium of the TIT selected Szekesfehervar to hold this summer university because computer technology manufacture takes place in the megye--in Szekesfehervar itself--and because certain results have been achieved already in the application of computer technology to agriculture and the SZUV [Computer Technology and Management Organization Enterprise] has developed model agricultural systems also.

As for the program, the fluent and outstanding cultural and professional programs which were held on a "schedule" precise to the minute and many other pleasant memories prove that Szekesfehervar regarded the holding of a successful summer university to be an affair of the heart, and it really was successful. Those participating in the summer university included workers from agricultural enterprises, institutions and universities and included economists, mathematicians, inspectors, bookkeepers, university teachers, system organizers, program planners, scientific department chiefs, agricultural engineers, managers, etc.

But they had a common interest: Where are others in the application of computer technology and what can we expect in the future (the computer technology conception of the ministry)? In addition everyone was curious about the opinion of the others (luckily everyone had an opinion) and hoped to get useful experience. Obviously it was this common interest which made for a very active gathering. (I will not praise them further because I was one of them.)

The program sent out 2 months earlier aroused interest too. We heard lectures on the following themes: agriculture and computer technology, computer technology and an information system for central guidance, guidance of an agricultural enterprise and computer technology conditions for it, the scientific-technological revolution and computer technology, computers and programming, computer manufacture by Videoton, use of computer technology in crop variety experiments, present

practice and future possibilities of real estate record keeping, plans for optimizing complex crop production technologies with special regard to soil management, use of computer technology in animal husbandry, computer technology in agricultural mechanization, and timely questions of agriculture and food affairs.

We had an opportunity to visit the Videoton factory, the Fejer Megye machine park of the SZUV, the Martonvasar research institute of the MTS [Hungarian Academy of Sciences], the Agard Agricultural Combine and its machine park and the Enying and Mor state farms.

One can mention here only a few ideas from the outstanding lectures; it is impossible to give them even in brief. So I would like instead to sum up the response to them and the lessons from them.

The Present Situation of Agriculture and Its Computer Technology Conception

"The value of agricultural equipment and fixed assets exceeds 300 billion forints; 25,000 experts with university or college degrees work in this branch. Every fifth hectare produces (directly or indirectly) for export but the branch is still capable of satisfying domestic demand. It is also true, however, that today for every one percent increase in value we need an increase in production three times what it was at the end of the first five-year plan, that a 2.9 percent increase in material expenditure or assets is needed for a one percent increase and that a one percent increase in export presumes a 2 percent increase in import. Our energy use exceeds by 21 percent that of the United States; as compared to 17 kilometers in 1970 there was 21 kilometers of transportation per ton of goods in 1977, which represents superfluous transportation of 20 to 25 percent respectively." I am quoting data from the opening address of Balazs Krucsai, a main department chief in the MEM [Ministry of Agriculture and the Food Industry] and chairman of the MEM SZAB [Committee for the Application of Computer Technology], and from the closing address of Dr Gabor Soos, state secretary of the MEM.

It was emphasized in the former address that the goal in agriculture is quality work, improving efficiency and improving and modernizing the level of leadership work. But rational management can be supported only on a modern information base. One cannot operate modern production systems with outmoded operational leadership. Since production concentration is the trend it is virtually impossible to guide this with outmoded management techniques. The priority task is to work out the information requirements for decision making by enterprise leadership because one should not mechanize the present leadership methods or order of business.

There are many officials in agriculture already but there is still need for new robot officials--computers. But these are only machines and they need trained experts, good data and suitable systems.

The application of computer technology in agriculture is still in its baby shoes in Hungary, primarily because according to the position of the MEM it is too expensive--not only the price of the machines but their operation also. (Although according to the introductory address not only the western countries but even several socialist countries are ahead of us in this area.) So the conception of the MEM is that only large associations and state farms can get computers; the national network of the SZUV may satisfy the needs of the enterprises.

But a review of the systems purchased and the lectures given all prove that the machines and systems operating do so for their owners and were developed by them. And despite the customary initial difficulties they are working well and have justified the hopes put in them. The agricultural experts were available and learning computer technology did not cause trouble for those "forced to it" but a few computer technology experts are employed also.

Where Should We Develop?

Even before the previously mentioned lectures were given and the lessons drawn, representatives of the SZUV provided a brief orientation about their work and, according to the conception presented, about the present status of the tasks falling to them and about their plans. They also reported on the models they have prepared for agricultural enterprises.

There can be no disputing that the SZUV has a staff of outstanding experts who can solve tasks of this kind. But I would like to mention two things. I asked: "Would they have to increase their machine park and number of experts to be able to handle all the agricultural enterprises in our country (134 state farms and combines, 1,369 producer cooperatives, 52 associations and 83 special cooperatives)? And if so would it not be the money of the same state that would be paying for MEM investments?" The answer--from an expert--was surprising: "Yes, but it would not be worth while for each producer cooperative to invest 80 million forints." Of course it would not be worth while, but luckily it is not necessary either. It is as if computer technology were still suffering from gigantomania, as if there were not cheap, small machines suitable for this purpose. The other question was put by someone from one of the state farms: "When will the SZUV convert to multiprogramming and the Job Accounting that goes with it?" The answer to this was no less surprising: "We are studying Job Accounting, but in the case of a multiprogram the running of the other programs could be ensured only if the customer himself provided the second, third, etc. programs!" But then the customers would need experts with the appropriate specialities. Without wanting to run down the SZUV or ruin their business, in the final analysis it is neither machines nor experts which justify the conception of the MEM in connection with the SZUV (but surely something else, about which there was no talk at Szekesfehervar).

Videoton Exhibit

In his opening address Academician Gyorgy Osztrovszki, vice president of the National Presidium of the TIT, noted that the ESZR [Uniform Computer Technology System] is just 10 years old and in the present "investment poor" year what is rational is intensive development, and that is what computer technology is. Among other things he called the attention of the audience to the fact that when the ESZR was formed every country made a bid, wanted to manufacture the larger machines, except Hungary, which wanted the little ones. After the development of the world trend even this proved to be too big. So they developed the Mini SZR. After this we awaited with interest the Videoton exhibit at the Summer University. We were not deceived in our expectations. Dr Csaba Barath, deputy director, informed us in detail about the activity of Videoton. His report on the new generation of Videoton computers and developmental trends answered viturally every question of the audience, without questions having to be asked.

Among other things he said that the world trend today is the disappearance of medium size computers, there are only small and large machines and batch processing is being replaced by the on-line (interactive) operational mode. (As examples he mentioned IBM and HP.) The reason for the development of small computers is the development of applications. The disadvantage of batch processing in business applications is that it is rather mystical and requires a large room and well trained operators. The demand today is for quick reaction and the little machines are most suitable for this and can be operated at the site of the task. The decrease in hardware prices means that while everything can be done on a large machine it is possible to use a small machine for special tasks (such as managing an agricultural operation).

Videoton developed its new generation of computers accordingly. The chief characteristics of it are: more models, larger storage and performance, reliability, servicability, modern technology and developed technology.

The New Computer Models

Model	Year of appearance	Characteristics	Price
ESZ 1010 M (VT 60)	1979	32-64 Kbyte, 5 Mbyte disk	10-12 million forints
ESZ 1011 (VT 600)	1979	1 Mbyte, FORTRAN COBOL 50 Mbyte disk	14-17 million forints
SZM 52	1981	under development	
VT 20	1980	64 Kbyte, microprocessor, display, floppy disk 1-3 1 Mbyte disk	
VT 30	1980		1.2-2.5 million forints

There is no need to say that the VT 20 system made the greatest impression on the students at the Summer University. "Its modular structure makes it possible to solve a broad range of problems with an optimal performance/price relationship, beginning with the floppy disk intelligent data recorder through the automatic bookkeeping stage all the way to data processing tasks."

Because of its compact structure it can be set up virtually anywhere (office, warehouse, etc.) and can be used in the following areas: bookkeeping, wage accounting, warehouse management, accounting, various information or record systems, etc. The price for the basic unit (32 Kbyte, one screen, dual diskette

2 x 250 Kbyte, matrix printer) is one million forints. The expanded version (64 Kbyte, 5 Mbyte magnetic disk, 4 work sites, chain printer) has a price of 2.3 million forints.

In conclusion Dr Csaba Barath reported that on 1 January 1980 Videoton would reduce the price on its computers.

We hope that these cheap little machines, which can be acquired not only with foreign exchange, will be considered in the development of the long-range computer technology conception for agriculture.

The first Computer Technology Summer University came to an end with a closing word by Dr Endre Lancz, Fejer Megye chairman of the TIT. He briefly evaluated the experiences of the 10 days and expressed his hope that we would meet next year also when we could compare and debate the results achieved by various branches in the application of computer technology. I think I can say in the name of every participant in the Summer University: We hope so too.

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OVERVIEW OF TPA-70 MINICOMPUTER PRESENTED

Budapest SZAMITASTECHNIKA in Hungarian Sep 79 pp 4-5

[Article by Pozsgay and Endrenyi: "The TPS-70 Minicomputer"]

[Text] The Central Physics Research Institute (KFKI) developed the TPA-70 minicomputer 6 years ago and handed it over to the Institute of Electrical Automation (VILATI) for series manufacture. The computer has already figured at a number of domestic and international exhibits and it is being used in five countries, in addition to Hungary, to carry out various tasks. We intend to report on the technical characteristics and software system of the computer and on several more interesting applications areas in several articles. We should note that this article was prepared on the basis of the "Handbook of TPA-70 System Elements." (The handbook was compiled by Janos Bogdany.)

General Characteristics

The TPS-70 minicomputer is characterized by its mature system technology, modularity, speed, reliability, broad peripheral selection and extensive basic software system. Together these attributes open a broad area for the most varied applications.

The minicomputer system consists of high performance processors, ferrite ring and semiconductor stores, background stores and a large number of peripherals. The TPS-70 computer is a 16 bit general purpose minicomputer made of highly reliable integrated parts.

The Bus System

One of the keys to the flexibility and efficiency of the TPA-70 is that all system elements (processor, memories and peripherals) are connected to one asynchronous, high speed bus, the MIOBUS (Memory-Input/Output Bus). The communication taking place on the two-direction MIOBUS lines is based on a hand-shaking master-slave system in which the control and response signals between initiating and subordinate units follow one another so that there can be links between devices with different response and operating times.

The MIOBUS conception means an efficient input-output system. The MIOBUS, the bus system of the TPA-70, makes input-output instructions superfluous; instead

the peripherals are controlled by simple data transmission. All peripherals connected to the MIOBUS have at least one condition register and at least one data register which can be addressed, written on and read as if they were locations in operational memory.

Of the 16 parallel interrupt request lines of the peripherals in the TPA-70 system the 8 with lower priority can request the central unit to interrupt the on-going program and initiate the routine serving them. The program interrupt system makes superfluous the slow and circuitous polling of peripherals in the interest of identifying devices requesting an interrupt and makes it possible to ensure an authorization level to the service routine independent of the priority of the request. Thus the interrupting routines can be embedded at any level without the use of special control routines. This dynamic interrupt request and authorization procedure makes possible a convenient and efficient use of the TPA-70 peripheral system.

A synchronous bus, the SIOBUS (Small Input/Output Bus), serves to control small peripherals. It is thanks to the SIOBUS that any small peripheral can be connected to the TPA-70 extraordinarily quickly. Changing or re-ordering the peripheral park can be done in a uniquely flexible manner with simple plug-in.

The TPA-70 makes it possible to develop special sub-buses, such as a MEMBUS linking the memory control unit with memory module cards or a DIOBUS (Direct Input/Output Bus) controlling fast peripherals--suitable for direct data transfer. The SIODIO adapter links the SIOBUS with the DIOBUS, making it possible for small peripheral units to carry out direct data transmission with memory or with each other without holding up the central unit.

The peripherals connected to the MIOBUS can carry out direct data transmission with operational memory or with other peripheral devices. Of the 16 parallel request lines of the MIOBUS the 8 with higher priority forward the direct data transmission requests of the peripherals to the central unit. In the course of the direct data transmission cycles there is no need for central unit supervision so the communication takes place without the intervention of the processor. A system operating on this so-called cycle-stealing principle is the fastest data transmission method, in the course of which the central unit can work on other tasks, thus increasing the utilizability of the machine.

The Central Unit

The central unit of the TPA-70 offers a rich variety of fast operations between register contents. The instruction system embraces all register and memory location combinations in regard to the location of the operand, including the operands included in the instruction(immediate operands). Conditional and unconditional branch instructions serve the program branches. The expanded arithmetic instructions constitute a standard part of the system. Efficient subroutine, section and supervisor call/return instructions and automatic hardware stack (sack memory) operations support the organization of a program.

The addressing system makes possible the addressing of byte, word and two-word operands. Among the addressing modes we can find direct/indirect indexing and relative and pointer addressing. Data ordered in large tables can be processed

very quickly with the aid of pre-autodecrement and post-autoincrement addressing methods, in which the value of the base register automatically decreases or increases in the course of the addressing process.

The program condition register contains indicator bits pertaining to the condition of the program being run, the interrupt conditions of the actual program and information pertaining to the result of the preceding operation.

The central unit of the TPA-70 has extensive system error check circuits, a power outage/restart possibility, memory protect, a programmable real-time clock and a PROM containing the program to be entered. In addition to the central unit special purpose processors can be connected to the MIOBUS too; these carry out various forms of arithmetic and logical processing. Such a device, for example, is the floating decimal processor.

Memories of different speed and construction can be used freely on the MIOBUS. The central unit can address a maximum of 64 Kbyte memory locations, or 256 Kbyte memory locations with the aid of a special memory organizing unit (Memory Management).

Power Units

In the TPA-70 systems the power units are located in separate mechanical units. They have an internal bus for powered output units which can be plugged in. The output units can be re-ordered in accordance with the performance requirements of the configuration. New modules can be used to increase the performance of existing voltages or to produce non-standard optional voltages.

The members of the newly developed industrial power unit family are control signal compatible with the older ones and can give 2-3 times the power for the same space and they can provide various output voltages.

Every power unit contains logic controlling the sequence of switching on and off and is supplied with protective circuits limiting surges appearing when switching on and other protective circuits. The power units of the TPA-70 system constantly watch the condition of each other via the MIOBUS lines and they switch on and off in synchrony with one another.

Peripherals

The TPA-70 peripheral registers can be addressed as if they were operational memory locations. The address domain of this can reach 4 K or 8 K depending on the position of a switch in the central unit, so the number of peripherals which can be connected to the MIOBUS can be very large. Very many types of peripherals can be connected to the TPA-70; one can find among them virtually every peripheral device manufactured in the socialist countries.

The TPA-70 background storage can be fixed and moving head, exchangable and flexible magnetic disk stores or IBM compatible magnetic tape stores with various data transmission speeds. The console peripheral can be alphanumeric display or teletype. Punch tape and punch card readers and punchers of various speeds,

line printers and matrix printers and graphic machines are available. Especially efficient systems can be built by using the graphic displays developed by MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences], the CAMAC modules of the KFKI and a multichannel analyser. Standard synchronous or asynchronous modems can be connected to the TPA-70 system. With the aid of various line adapters one can avoid using the modems at limited distances.

Photo caption: Designing printed circuits with a TPA-70 computer at the MTA SZTAKI.

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THE SEDAN DATA-HANDLING SYSTEM

Budapest SZAMITASTECHNIKA in Hungarian Oct 80 p 14

USZTA, Jozsef

[Abstract] The SEDAN data-handling system--a Soviet-developed OS/ES-based system--was designed to establish and handle data bases with a network structure, capable of actualizing, reorganizing, and managing data systems. It generates the data base with network structure from the user program, batch-processes the data in the MFT or MTV operating mode, protects the data in case of hardware faults, to a degree repairs damaged data bases, deploys the individual data in an optimum way for access and actualization, integrates data, and provides access to the data on the basis of various criteria. It has utility program packets for the required functions, and can perform insertion, replacement, and data-management operations. The system can be run on an ESEK module, provided that it has a 128 kbyte operative memory, a multiplex channel, a selector channel, a magnetic-disk unit, a magnetic-tape unit, a console typewriter, a punched-card reader, and a line printer. Operation is possible in the single-task, multi-task (single-partition), and multi-task (multi-partition) modes. SEDAN enables the user to define the data base in a formated manner and to establish its structure. The data-base handling system can be initialized and closed: files can be opened and closed; direct and sequential search can be conducted, records can be replaced, cleared, and inserted; and various special procedures can be implemented. In the data-teleprocessing mode, the SEDAN system uses the INTERSEDAN program packet. This program packet acts like an interface between the SEDAN system and a data teleprocessing system such as the KAMA. To operate INTERSEDAN, the following hardware facilities are required: 256 kbyte operative memory, two-magnetic-tape units, punched-tape reader, line printer, and terminals for the data-teleprocessing operation. The input data are data-base definitions, messages from the terminals, and data bases generated via SEDAN. The output data are messages appearing on the terminals from the user programs, the SEDAN data base, and the SEDAN system diary. Means for data security are provided. The INTERSEDAN system may be the basis for a dialog-mode information retrieval system as well as a remote data-handling system.

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POLISH-CUBAN-CZECH SCIENTIFIC COOPERATION OUTLINED

Warsaw NAUKA POLSKA in Polish No 11-12, Nov-Dec 80 pp 111-118

[Article: "Agreements on Scientific Cooperation"]

[Text] On 6 June 1980 Tadeusz Orlowski, first deputy secretary and regular member, Polish Academy of Sciences [PAN], and Dr Ismael Clark, vice president and general scientific secretary, Cuban Academy of Sciences [ANK], signed a protocol on scientific cooperation between the PAN and the ANK for 1981-1985.

The cooperation accomplished during the 1976-1980 period was evaluated during the talks. It was stated that many good results were achieved, especially in preparing a geological map of Matanzas province, in research concerning applications of ultrasonic techniques and in geographic research.

Bearing in mind the results already achieved and the possibility of expanding cooperation and its goals, a problem-theme plan for cooperation during the 1981-1985 period was agreed to. This plan encompasses 13 problems in the fields of botany, geography, geology, acoustics, ultrasonic applications, science study, scientific information and the social sciences. The following PAN institutions will participate in the cooperation: the Institute of Ecology, the Institute of Botany, the Institute of Geography and Territorial Development, the Institute of Geological Sciences, the Institute of Basic Technical Problems [IPPT], the Committee on Science Study, the Institute of Philosophy and Sociology, the Institute of Literary Research and the Center for Scientific Information. In addition the plan calls for interlinking cooperation in physics and theoretical mathematics, and expanding cooperation in the natural and social sciences.

It was agreed that the cooperating institutions of the two academies will sign concrete 2-year and 3-year working plans which will list goals, tasks, responsible individuals, expected results, forms of cooperation and other conditions that are essential to execute the planned work.

The financial and organizational conditions necessary to realize the tasks and to exchange personnel were also established. It was mentioned that during the 1976-1980 period the PAN Institute of Geological Sciences concluded research on drawing a geological map of Matanzas Province. It is expected that the map will be completed in 1980. At the thematic conferences on the geological mapping of Cuba which were organized by the ANK Institute of Geology and Paleontology, the Polish geologists who are drawing the map delivered the paper "Notes on the Genesis of Some Quaternary Terigenetic Deposits of Western Cuba," which is in preparation for publication.

Within the framework of the problem "Investigation of the Stratigraphy, Facies Formation, Geomorphology and Tectonics of Selected Cuban Regions," the following works have been submitted for publication: "The Nappe Structures of Western Cuba on the Pattern of the Sierra de los Organos," and "The Geosynclinal Successions of Cordillera of Quaniquanico in Cuba: Their Lithostratography, Facies Development and Paleogeography." The composition, lithology and facie of the Polier formation in the Sierra del Rosario, as well as the cretaceous deposits in structures of the northern part of Matanzas Province, were investigated. Research was also done on the mezostructures of the Havana-Matanzas-Madruga anticlines. This was followed by an analysis of the melange structures in Pinar del Rio and Matanzas provinces. The results of these investigations were presented at scientific sessions organized by the ANK and at the 5th Geological Congress of Latin America held in the Republic of Trinidad.

The primary purpose of the IPPT's collaboration on the problem "Investigation of the Rudiments and Applications of Ultrasonics" was to help to organize an ultrasonics laboratory to investigate technological processes in industry, and to train and improve scientific cadres. IPPT representatives gave lectures and advised Cuban specialists in ultrasonic measurements and propagating elastics waves in homogeneous media and structural components; applying ultrasonic measurements in the sugar production process and in medical diagnoses. During the 1976-1980 period, one Cuban specialist earned a doctorate at the IPPT.

Within the framework of cooperation with the ANK Institute of Botany, the PAN Institute of Botany carried out 600 preparations for the palinologic atlas, prepared diagnoses for 35 species causing allergies and prepared photographic documentation for them. As specified in the plan, two Cuban specialists earned doctorates.

Cooperation in the social sciences concerned primarily history and archeology. Among other things, lectures were given on applying qualitative methods in history research, archeologists were trained and research on excavations was conducted. As a result of investigation work, the oldest and exceptionally rich paleolithic settlements in Cuba were discovered.

Active scientific contacts are also being maintained by the PAN Institute of Geography and Territorial Development whose representatives participated, among other things, in research on locating industries in Cuba, and also by the PAN Committee on the Study of Science, whose representatives delivered a series of lectures on organizing and planning research and also printed lecture notes in this area.

Within the framework of scientific and technical cooperation with the Cuban National Center for Scientific Research, the PAN Institute of Animal Physiology and Nutrition, the PAN Research Center for Experimental and Clinical Medicine and the PAN Institute of Immunology and Experimental Therapy accepted 17 specialists independent of the bilateral cooperation themes.

At the invitation of the Czechoslovak Academy of Sciences [CSAN], a PAN delegation consisting of J. Kaczmarek, PAN scientific secretary and regular member; H. Cholaj, PAN Section I first deputy secretary and corresponding member; J. Haman, PAN Section V deputy secretary and regular member; and other experts spent 11-14 June 1980 in Czechoslovakia. The purpose of the trip was to establish the scope of cooperation

between the PAN and the CSAN for the 1981-1985 period, to conclude an agreement on scientific cooperation between the PAN and CSAN, and to participate in a commemorative scientific session organized by the CSAN to celebrate the 25th anniversary of cooperation between the academies.

During the discussions it was stated that the plan for scientific cooperation for the 1976-1980 period was successfully realized, and the achieved results contributed extensively to the development of multilateral cooperation between the academies.

Based on the proposals announced by and agreed to by the scientific institutions, a problem-thematic plan for cooperation was developed which encompasses 14 problems and 61 themes. The plan excludes problems and themes incorporated in multilateral cooperation programs. Both academies will cooperate in the following areas: solid-state physics and condensed systems, materials engineering, applications of acoustical methods in technology, mathematical theories and their applications, geodynamics and geophysics, physiochemical technological bases, territorial use and management of water resources, natural environment investigations, parasitology, physiological and genetic processes occurring in organisms of domestic animals, molecular biology and genetics, law, altering socioeconomic structures and social consciousness, and developing national culture.

It was agreed that selected themes will be emphasized in the form of scientific cooperation, namely in the physics and technology of magnetite; the bases for the production of metals, alloys and composite materials; the struggle against mine falls in mining basins; bases for integrated protection of plants; physiological and biological processes related to the use of nitrogen; and documents and material on the history of Polish-Czechoslovak, Polish-Czech and Polish-Slovak relations in the history of material culture and art.

It also was determined that the scientific institutions named in the problem-theme plan will prepare by 31 January 1981 concrete working plans in which goals, tasks, expected results, executors, time limits and other conditions of cooperation will be designated.

Independent of the established themes, both academies will cooperate in the exchange of scientific equipment and material, publications, patents, licenses, and technical and scientific information, as well as encourage consultations among workers in other specialized services.

It was decided that jointly prepared documents will be considered to be completed only after they are in preparation for joint publication. Other organizational and financial conditions that are necessary to realize the adopted resolutions were approved.

In association with the expanding area of cooperation and the passage to new, more effectual forms that take into account the principles of socialist division of labor, and in evaluating positively the realization of agreements to date concerning scientific cooperation between the PAN and the CSAN since 24 November 1960, a new agreement was signed establishing the principles of cooperation between the academies. This agreement states that the primary purpose of cooperation is to jointly resolve important tasks facing scientists of both nations that will be realized mainly via coordinated research, cooperation and joint research teams. It also specifies

principles of cooperation in the areas of reciprocal transmission of information concerning tasks, development plans and concepts, legal and organizational resolutions, experiences in administration of both academies, and also information in the area of scientific research and scientific-research achievements, and of activities in international scientific organizations and other areas related to research activity.

It was agreed that both academies will collaborate in training and improving scientific cadres, in exchanging scientific information, publications, scientific documentation, patent and license policies, as well as in interchanging, supplying and equipping scientific-research apparatus, equipment and material.

Considering that the joint awards that were established for the best results achieved in cooperative efforts are stimulants for creative activity among international research groups, it was decided to continue this form of recognition for scientists.

The agreement also specifies the organizational and financial issues of cooperation, including time periods for signing executory documents for the agreement, principles of exchanges that do not involve foreign exchange currency, employment and so forth.

The agreement was for an unspecified period.

The protocol on scientific cooperation between the PAN and the CSAN for the 1981-1985 period and the agreement of 13 June 1980 were signed in Prague for the PAN by J. Kaczmarek, PAN scientific secretary and regular member, and for Czechoslovakia by Academician J. Riman, scientific secretary.

On 13 June 1980 a scientific session was convened to commemorate 25 years of cooperation between the academies. The PAN delegation, representatives of the CSAN and Slovak Academy of Sciences [SAN] presidiums, representatives of the Department of Education and Science of the CPCZ Central Committee and the Polish ambassador to Czechoslovakia, Comrade J. Mitrega, were present.

Prof Dr J. Kaczmarek, PAN scientific secretary, delivered a paper on the scientific ties between the academies and on PAN research goals for the next 5 years.

In the introduction to his paper he characterized the historical scientific links, especially the tradition of cooperation between Charles University in Prague and the Jagiellonian University in Krakow, which are examples of the dependence and mutual permeation of progressive social and scientific ideas. This concerns N. Copernicus and the Czech astronomer Jan Hajka; the great Czech reformer, Jan Hus; the father of modern pedagogy, Jan Amos Kominski, who spent 27 years in Poland; and so on. Such examples also abound in modern times. Polish science is well acquainted with the works of such scholars as B. Brauner, B. Hrozny, L. Niederle and Jaroslav Heyrovsky, Noble Prize laureate. In the opinion of the speaker, the world achievements accomplished by Czechoslovak scientists in selected branches of science are proof of the overall correctness of small but highly developed countries like Poland or Czechoslovakia knowingly influencing and using basic research. Obviously small countries cannot create experimental and scientific bases that are equal in all areas; they must concentrate on those segments where they have the capability of

achieving a world position, using the results of world science as a source of civilizing and scientific-technological progress. Further on, Dr J. Kaczmarek described the more important results of the cooperation between the academies that were achieved in the current 5-year period. Then, considering the new needs and tasks, he mentioned the need to extend and expand cooperation in research on new sources of energy, food and raw materials; construction of scientific-research apparatus and equipment to automate research; study of science and science policy problems; improvement of methods planning and financing; effective coordination of research; and the like.

The speaker then presented guidelines for a basic research program for the 1981-1985 period. He took into consideration the research trends resulting from the resolutions of the Eight PZPR Congress and the Second Congress of Polish Science, including: seeking new energy sources; using water resources and the resources of the sea; the theoretical physics, mathematics and physical properties of solid bodies; space research and its practical applications; bases for chemical processes and physiochemistry in the area of materials engineering; integrated systems for the automation of production and management of the economy; research on shaping and protecting the environment and on low-waste technology; genetic engineering and microbiology, especially virology and their applications in agriculture, medicine and industrial production; research on using protein from polar areas of the seas and research on the ecology of Poland; photosynthesis processes and optimization of protein production; the aging processes in human beings; research on the elements of a developed socialist society and modification of its structure; research on the family and optimization of demographic processes; and national culture and history.

Prof Kaczmarek then mentioned the influence the PAN has on shaping plans in the area of the national economy and culture by, among other things, developing expertise and prognoses concerning various divisions of socioeconomic life.

During the session the 1980 prizes awarded jointly by the PAN and the CSAN were announced. The following authors and works won awards:

"Documents and Material Relating to the History of Polish-Czechoslovak Relations During the 1944-1960 Period."

This imposing and extensive work (over 110 articles by the author) presents a multilateral and well documented picture of Polish-Czechoslovak relations (political, economic, interparty, cultural, scientific, and in tourism and sports) during the first postwar years and during the period of building socialism. The following Poles received awards: Doc Dr hab W. Balcerak, deputy director for scientific affairs for the PAN Institute of Socialist Countries and deputy chief editor of the JOURNAL OF POLISH-SOVIET RELATIONS AND THE DEVELOPMENT OF THE SOCIALIST COMMONWEALTH; Dr J. Lukanty, author of many publications and adjutant at the PAN Institute of Socialist Countries, who is concerned with Polish-Czechoslovak relations after World War II; and Dr L. Buczma of the Polish Foreign Affairs Institute, author of many scientific works on postwar Czechoslovak history.

The following Czechoslovaks won awards: Prof Dr V. Kral and Doc Dr V. Melichar of the CSAN Soviet-Czechoslovak Institute, and Dr V. Borodovcak of the SAN Institute of History of European Countries.

"Cycle of Works on the Morphology, Ultrastructure, Histochemistry and Immunological Processes of Cysticercus Bovis."

Research on cysticercus bovis (tapeworm larva of taenia saginata) is original work in the field of immunology that was done under defined experimental conditions on parasites from diseased animals. The achieved results contribute to the understanding of phenomena occurring in a host-parasite system, especially the development and physiology of a parasite and the host's reaction, that is its pathology with special consideration of its immunology and the elimination of a morbid specimen that presents a danger to man and at the same time causes significant economic losses in cattle production.

The following Poles won awards: Doc Dr hab B. Machnicka-Rowinska of the PAN Department of Parasitology, who works on basic problems of immunology such as the antigenetic structure of parasites, immunological reactions of the host in the form of humoral- or cell-type immunity, and applied immunology; R. Romanowska, technician and author of original work on experimental trichinosis.

The following Czechoslovaks received awards: Dr J. Slais, Dr Z. Zdarska and Dr J. Sterba of the CSAN Institute of Parasitology.

"The Discovery of New, Unknown Properties of a Live, Isolated Cat Brain."

As a result of the conducted investigations, two important properties of a live, isolated brain, obtained by cutting the stem of a cat brain at the rootlets of the trifacial nerves, were ascertained, namely: a) It was shown that in the hippocampus of an isolated brain the optic stimulus causes normal electrophysiological reactions. The results show that removing the controls from the lower stem of the brain does not change qualitatively the activity of the retiform-cephalic-hippocampus system. b) In an isolated brain, instrumentated conditioned reflexes and their differentiation are produced. The results are of practical and cognitive significance in the field of therapy for people having severe brain damage.

The following Poles received awards: Prof Dr hab B. Zernicki, director of the Neurophysiological Department of the PAN, N. Necki, Institute for Experimental Biology and author of many works on the physiology of the optic system and characteristics of an isolated brain; and Dr A. Michalski, employee of the Neurophysiological Department.

On the Czechoslovak side, Doc Dr T. Radil-Weiss of the CSAN Institute of Physiology also received an award.

Official cooperation between the PAN and CSAN began in 1956. During the 1976-1980 period cooperation encompassed 61 themes grouped within 23 problems that were closely associated with plans included in government programs, and with intergrated and interministerial problems. They were realized either in the form of scientific cooperation or coordination. Such a division of tasks which takes into account the needs and capabilities of the cooperating institutions brought about the planned utilitarian and cognitive results. Among the many results, the following should be mentioned:

In the Social Sciences. A handy Czech-Polish dictionary, now in print, a Czech-Polish phrase dictionary, and a volume entitled "Polish-Czech and Polish-Slovak Literary Relations During the 1890-1939 Period," which was submitted for publication, are works by the PAN Institute of Slavic Studies. The PAN Institute of the Polish Language in collaboration with the CSAN Department of Foreign Languages published the medieval Bible of Queen Sophie with a parallel Czech text. Presently these institutions are jointly working on a Latin-Polish mammotreptus (a Bible commentary) of which two parts have already been published. The PAN and CSAN Institutes of Philosophy and Sociology are jointly preparing editions of the following philosophy texts:

Wikliwa: "De Universalibus, De Ideis," and Mateusz of Krakow: "Sermones." In preparation are works on the registration of Polish studies and Bohemian studies scholars, research on humanism in Krakow and Prague, recording of commentaries on works of Aristotle, philosophy at Charles University, and a monograph on Czech philosophy in the 14th and 15th centuries. The PAN Institute of Socialist Countries, the CSAN Czechosloval-Soviet Institute and the SAN Institute of History of European Countries jointly published Volume 1 of "Documents and Material Relative to the History of Polish-Czechoslovak Relations During the 1944-1960 Period." The PAN, CSAN and SAN Institutes of History are cooperating within the framework of the Historical Commission which was created in 1959. As a result of this cooperation many works have been published including: "The History of Poland" by Czechoslovak historians, "The History of Czechoslovakia" by Polish historians, "Studies on the National Development of the Poles, Czechs and Slovaks" and "Historical Consciousness of the Epoch of Socialism." The PAN Institute for the History of Science, Education and Technology in collaboration with the CSAN Institute of General History and Czechoslovak History completed work on the joint monograph "Problems of Teaching the History of Science and Technology in Poland and Czechoslovakia." An English and German translation of this monograph will be published in Czechoslovakia this year.

In the Biological, Medical and Agricultural Sciences. The PAN Institute for Immunology and Experimental Therapy and the CSAN Institute of Molecular Genetics are jointly conducting research on immunological cell reactions in birds and their chemical and surgical reactions. The achieved results are being directly applied to laboratory practice representing an experimental model to be used to evaluate medicines selectively acting in the bursa-thymus system. The research results were published in five joint publications. The PAN Institute for Experimental Biology and the CSAN Institute of Physiology have developed a method for the multichannel recording of bioelectric activity in normal muscles and in muscles subject to various operating processes with the aid of surgically implanted electrodes. Information was also obtained concerning unknown characteristics of a live, isolated cat brain. During the 1976-1980 period, results of the cooperation between the two institutions were presented in 21 publications and papers delivered at scientific conferences. The PAN Department of Parasitology together with the CSAN Institute of Parasitology are collaborating on combating cysticercus of cattle. In 1980 this cooperation won a joint PAN CSAN award. The PAN Department for Nature Protection and the CSAN Institute of Entomology are cooperating on problems related to the pathology of insects, the goal of which is to introduce into plant protection practices new microorganisms as means of combating insects that harm forests. The resulst of this work have been presented in two joint publications. The PAN Institute of Biology is cooperating extensively with its Czechoslovak counterparts

in such areas as the distribution and migration of some species and communities of synanthropic plants, and the vegetation of the Carpathian mountains in regions adjoining the border. The PAN Institute of Animal Physiology and Nutrition and the SAN Institute of Physiology of Farm Animals are working on the theme "Physiological and Biological Processes Related to the Use of Nitrogen." The purpose of this cooperation is to increase knowledge about biosynthetic processes through which some farm animals use nitrogen in nonprotein compounds into animal protein. The research results were published in six joint publications. In 1979 this work won the joint PAN and CSAN award.

In the Mathematical, Physical and Chemical Sciences. The CSAN Institute of Solid State Physics and the PAN Institute of Physics jointly evolved the structure of the contrast of an X-ray diffraction region for dislocations in the so-called Bragg case. The discovery became the basis for developing a method to determine the local orientation in the environment of a dislocation. The PAN Department of Solid State Physics and the SAN Electrochemical Institute conducted research on the effects of tunneling in thin-film structures with a thin CD_3AS_2 film at helium temperatures, which resulted in the development of a new method and technology for tunnel joints. The PAN Institute of Low Temperatures and Structural Research and the CSAN Institute of Physical Metallurgy, within the framework of research on the electronic structure of metals, developed a method for computing the nucleus of a system of integral equations for wave functions based on a numerically assigned function. This method enables computation time to be shortened 20-fold. In the framework of cooperation between the PAN Institute of Physical Chemistry and the CSAN Institute of Physics in researching the mechanical, thermodynamic and electronic properties of metal-hydrogen, the Czechoslovaks developed a method to measure dilations under conditions of high hydrogen gas pressure based on measuring the electrical capacitance in situ. This method will be experimentally verified at the PAN Institute of Physical Chemistry.

In Earth Sciences and Mining Sciences. The PAN Institute for Geological Sciences and the SAN Geological Institute jointly developed a technique for dating nonhomogenous material. The PAN Institute of Geophysics in collaboration with the CSAN Institute of Geology and Geotechnology completed construction of a wide-band seismological station at the Lower Silesia Geophysical Observatory in Ksiaz. An identical station operates in Czechoslovakia at Kasperski Hora, and a station is under construction in the GDR. These stations will form a so-called seismological observation triangle, the only one in Europe, which will permit the buildup of the Earth's upper crust and ongoing processes within it to be monitored. It also will permit the recording of seismological phenomena occurring at frequency ranges that to date are unheard of. One of the institute's works entitled "Investigations of Deep Structures on Profiles Bisecting the Carpathian Mountains by Electromagnetic Induction Methods" won the PAN and CSAN award in 1979. The PAN Institute of Rock Mass Mechanics sent documentation for prestress strain gauges to the SAN Mining Institute. The PAN Institute of Geography and Territorial Development and the CSAN Institute of Geography are collaborating in the field of modern processes of industrialization and urbanization in Poland and Czechoslovakia.

In the Technical Sciences. The PAN IPPT is collaborating with its Czechoslovak counterparts in diagnosing the distributions of parameters in an inert and ionized gas maintained in a plasma with the aid of a high power CO_2 laser, and in identifying cushioning elements. The results of the conducted investigations were published.

The PAN Institute of Turbo-Machines is cooperating with the CSAN Institute of Plasma Physics on designing microwave generators needed to generate plasmas for chemical reaction purposes. A joint publication has been prepared and experimental work is in progress. The PAN Institute of Hydroengineering and the SAN Institute of Construction and Architecture, within the framework of work on strength of materials and structural elements, are conducting joint research on the effect of mechanical strain on absorptive properties of "Kuzmica" bentonite. Research results will be given in a joint publication. The PAN Institute for Basic Metallurgy, the CSAN Institute of Physical Metallurgy and the SAN Institute of Metallic Materials are conducting joint research on the structural and mechanical properties of aluminum-reinforced sheet metal and rods and the properties of copper subject to deformation. Six publications are in print, and in 1979 the group won the PAN and CSAN award for its work.

Bilateral scientific symposiums or symposiums of an international character that are organized annually are a form of cooperation between the two academies. These include: the Polish-Czechoslovak catalytic colloquiums (first one occurred in 1962), the Polish-Czechoslovak symposium on geophysics of mining (1976), the Polish-Czechoslovak symposium on physics of soil water (1978), the Polish-Czechoslovak symposium on geophysics (1976), the Polish-Czechoslovak-GDR winter schools on differential geometry (1977), the international conference in the mathematical bases of information science, and the international conference on isoprenes.

The PAN Center for the Dissemination of Scientific Publications cooperates on the basis of direct agreements with academia, the CSAN publisher in Prague, and with Veda, the SAN publisher in Bratislava. Within the framework of cooperation, two exhibits of Polish scientific publications are shown annually in Czechoslovakia (one on Czech territory and one on Slovak territory), and Czechoslovak publications are exhibited in Poland.

Based on direct agreements, scientific associations of the two countries are cooperating. Such agreements were made by the Polish Mathematical Association, the Polish Chemical Association, the Polish Entomological Association, and the Polish Folklore Association with their Czechoslovak counterparts.

During the 1976-1979 period, 1,986 individuals went to Czechoslovakia to conduct research, to participate in scientific conferences, and to engage in training and consultation, and so forth; in turn, the PAN hosted 2,705 Czechoslovak scientists and scholars.

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CURRENT, LONG-RANGE DEVELOPMENT OF HYBRID CIRCUITS DESCRIBED

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[Article by Dr Eng Zbigniew Szczepanski, Warsaw Polytechnic Electronic Technology Institute: "Hybrid Circuits, Current Status and Development Prospects"]

[Excerpts] Applications of Thin-Film Hybrid Circuits

The development of thin-film hybrid circuits in Poland began in 1968 when the Institute of Telecommunications [ITR] Microelectronic Plant began work on these circuits. Thin-film hybrid circuits are produced mainly by the Lower Silesian Electronic Plants [DZE] DOLAM in Wroclaw where production of these circuits was initiated in 1976 based on technical help from the USSR. These circuits, which are used for mobile radio communications, are also produced by the RADMOR Radio Plants in Gdynia and, till a short while ago, by the Electrical Installations Enterprise [PIE], where new circuits and applications were developed.

The main applications for thin-film hybrid circuits are telecommunications, teletransmission, metrology and digital technology. Currently the following components use thin-film technology: wide-band amplifiers, operational amplifiers for information science and measuring-control devices, teletransmission amplifiers as well as teletransmission signal amplifiers, voltage amplifiers, high-frequency amplifiers for radio communications, voltage dividers, precision and high-stability resistors, high-stability precision resistor assemblies for analog automation, thin-film regulators for electronic calculator feeders, resistors, attenuators, resistance lattices, digital circuits for industrial automation, radio communication and control equipment, and microwave integrated circuits.

Very often these amplifiers have input stages consisting of field-effect transistors to provide very large input resistances (such a design is used in the high quality type 7006 operational amplifier produced in Poland) which assures a very small current drift and significant reduction of internal noise.

To understand and compare thin-film circuit characteristics, technical data for several thin-film operational amplifiers produced in Poland (first two types) and abroad are shown in Table 2.

The increasing demand for thin-film hybrid circuits, especially by enterprises producing special devices, is proof of the large role these circuits play in modern electronic devices. Thus it is projected that over the next several years production of these circuits will multiply several times (in 1979 about 500,000 were produced).

In Poland thick-film hybrid circuits are produced by the Krakow Electronic Plants [KZE] TELPOD. They started production in 1972 based on a license purchased from the Belgium firm Sprague.

Table 2. Technical data for several operational amplifiers based on thin-film technology.

1) Układ / 3) Parametr	2) Jednostka	L 7003 PIE	L 7004 PIE	150 Zelitex	830 Zelitex	ADO 22 Fairchild	ADO 22 Fairchild
4) Wzmocnienie w układzie otwartym	10^3 V/V	60	60	10^3	300	75	75
5) Napięcie wejściowe niezrównoważenia	V	0,007	0,01	0,05	1	5	3
6) Pasmo przenoszenia przy $k=1$	MHz	10	10	10	1,5	1,8	5
7) Impedancja wejściowa	MΩ	0,5	0,07	1	10^3	0,3	10^3
8) Współczynnik tłumienia napięcia wspólb.	dB	85	85	86	66	86	80
9) Wejściowy prąd polaryzacji	nA	10	50	0,05	0,02	45	0,05
10) Dryft temperaturowy prądu	nA/deg	0,15	0,2	0,101	0,6	2	2
11) Amplituda napięcia wyjściowego	V	±10,5	±11	±10	±10	±10	±10
12) Moc tracona	mW	300	30	—	—	—	—
13) Dopuszczalny prąd obciążenia	mA	—	—	4	5	20	20

Key:
1. Circuit
2. Unit
3. Parameter
4. Open circuit amplification
5. Unbalancing input voltage
6. Transfer bandwidth
7. Input impedance
8. Synchronous voltage attenuator factor
9. Input bias current
10. Drift current/temperature
11. Output voltage amplitude
12. Power dissipation
13. Permissable supply current

The 15-, 25- and 50-watt power amplifiers based on thick-film technology are used in hi-fi systems and telephone exchanges.

Because of the large permissible power rating of thick-film resistors--up to 30 W/cm^2--large-power resistors or resistor networks can be manufactured using this technology. Thick-film resistors produced in Poland will be used in Jowisz TV receivers.

Currently about 200 types of thick-film hybrid circuits are produced in Poland, and the demand for these circuits is constantly increasing which is an indication of their extensive applications.

Seven million thick-film hybrid circuits were produced in 1979, barely satisfying 70 percent of the demand.

Development Trend of Hybrid Technologies in Poland and the World

The dynamic growth of hybrid technologies in Poland is occurring simultaneously with the growth in demand for hybrid circuits and with the growth of their role in the world. According to U.S. forecasts, in 1985 world production of monolithic circuits will exceed $3 billion, and the value of hybrid circuits will exceed $1 billion. The value of hybrid circuits produced in the FRG in 1978 was 100 million marks, and in 1985 it is expected to be 300 million marks. In the highly developed countries, the ratio of the value of monolithic circuit production to the value of hybrid circuit production is 3:1. In these countries hybrid technology encompasses very large product assortments, from simple resistor structures to LSI (large scale integrated) multifilm circuits.

The level of hybrid technology in Poland, represented by KZE TELPOD and DZE DOLAM, now makes it possible to manufacture simple small scale integrated circuits, primarily encased semiconductor components based on thick-film technology, and separately encased semiconductor components based on thin-film technology.

Despite the planned 100 percent increase in the production of hybrid circuits in Poland for the 1980-1985 period relative to 1979, the demand for hybrid circuits will not be completely satisfied because demand is significantly greater than current production capacity. The gap between hybrid circuits supply and demand will increase unless appropriate steps are taken.

Analyzing the demand for hybrid circuits in specific assortment groups for 1985, one can see that the greatest increase in demand will occur in the assortment for motorized equipment where a 200-fold increase in the amount of produced circuits is planned.

Increasing requirements relative to newly produced hybrid circuits is another important problem. Certain areas of electronics--for example, information science--are interested primarily in LSI circuits which cannot yet be produced in Poland because of Poland's present stage of hybrid technology development. Thus, the process of initiating the production of multifilm circuits must be accelerated to significantly increase the degree of integration.

To resolve the presented problems, we must quickly implement qualitative changes in the technology of these circuits. To resolve the basic problems, qualitative changes in the technology of these products must be implemented as soon as possible. Above all this should concern: improvements in designing circuits using electronic digital computers; expanding production capacity and assortment in the area of uE semiconductor components and nonencased, passivated components; initiating production of semiconductor components and integrated circuits with flip-chip type leads at the Scientific-Production Center for Semiconductors [NPCP]; and mechanizing assembly operations for encased components to realize higher reliability circuits and greater packing densities. It also is necessary to take steps in the area of

technological equipment to implement new technology and to increase production capacity. In particular this will concern the purchase of such technical equipment as multizone kilns for baking films, laser equipment to equalize resistors, precision screen printers, laser equipment to trim base boards, equipment to automatically assemble encased discrete components, equipment for photolithographic processes, and equipment to hermetically seal circuits.

Implementing the production of the following should also be accelerated: new Polish developments in the area of resistivity pastes and conduction pastes, glass bases, silicones to protect semiconductor structures, conductive adhesives, fluidizing and overpressing resins, and a number of other imported materials. Seventy percent of the materials used in hybrid circuit production is imported. Therefore, using a new type of Polish material will be a great accomplishment and will encourage the development of hybrid technologies and, at the same time, reduce microcircuit production costs.

It also would be desirable to initiate work on introducing glazed steel bases, which are being used increasingly by Western firms.

Although it would be very difficult to achieve a semiconductor technology equal to the world level, realistic possibilities exist for Poland to achieve an average world level in the production of specialized hybrid circuits. We should take immediate action to enable us to satisfy the constantly increasing demand for hybrid circuits.

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